NOTICE TO INSTALLER: Instructions must remain with installation.

"Quality Pumps Since 1939"

Product information presented here reflects conditions at time of publication. Consult factory regarding discrepancies or inconsistencies.

FM2391
0207
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ZOELLER® PUMP CO.

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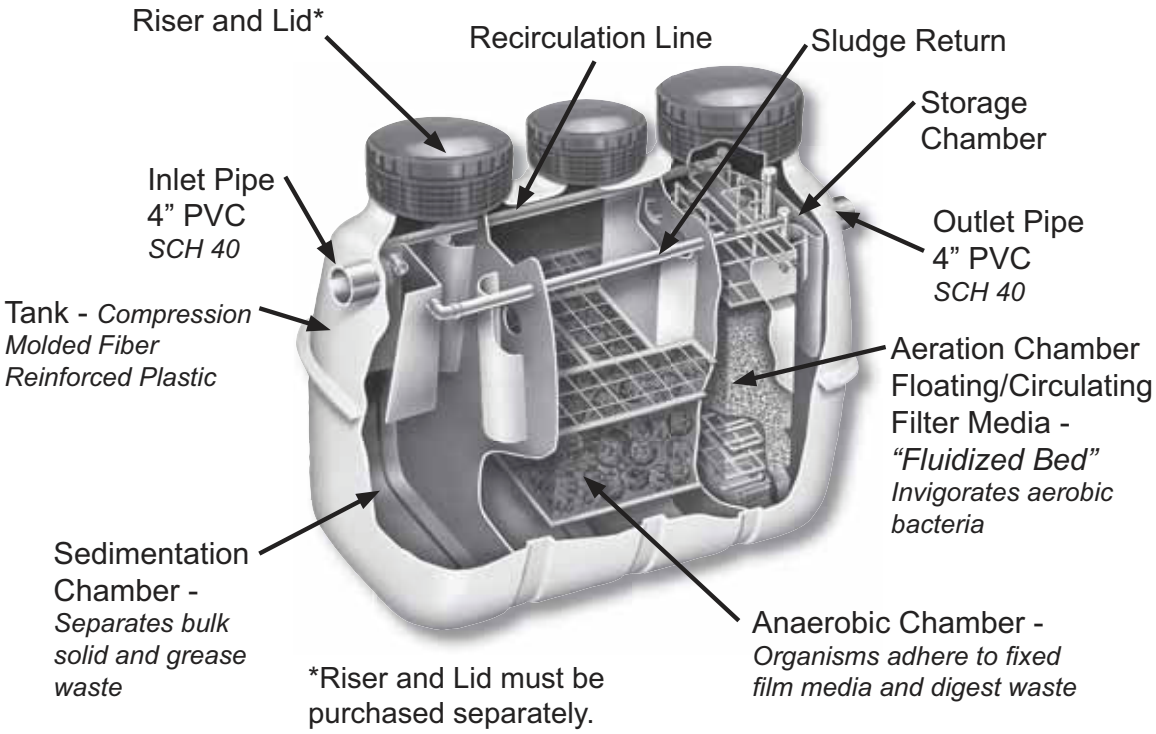
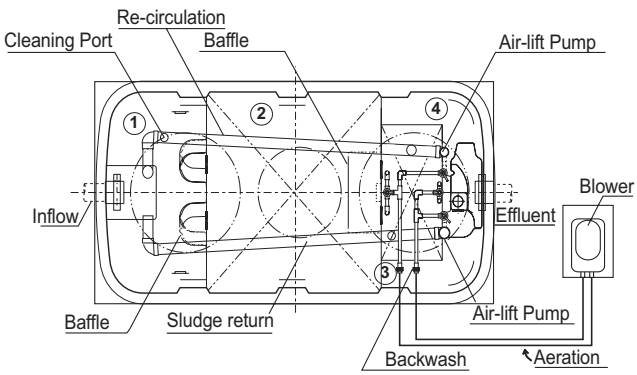
OPERATION AND MAINTENANCE MANUAL

FUSION SERIES TREATMENT SYSTEMS

HOW THE FUSION SYSTEM WORKS





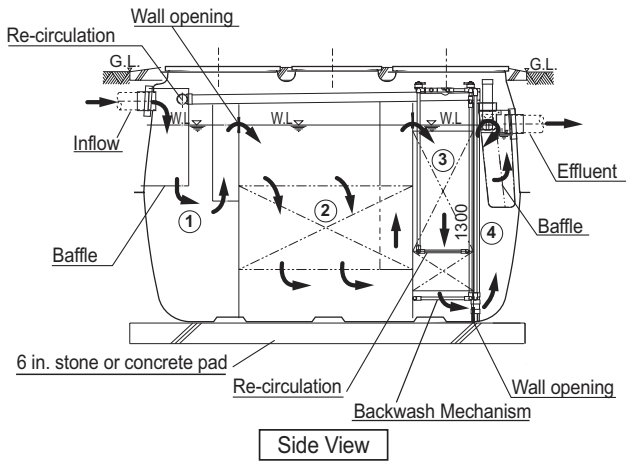
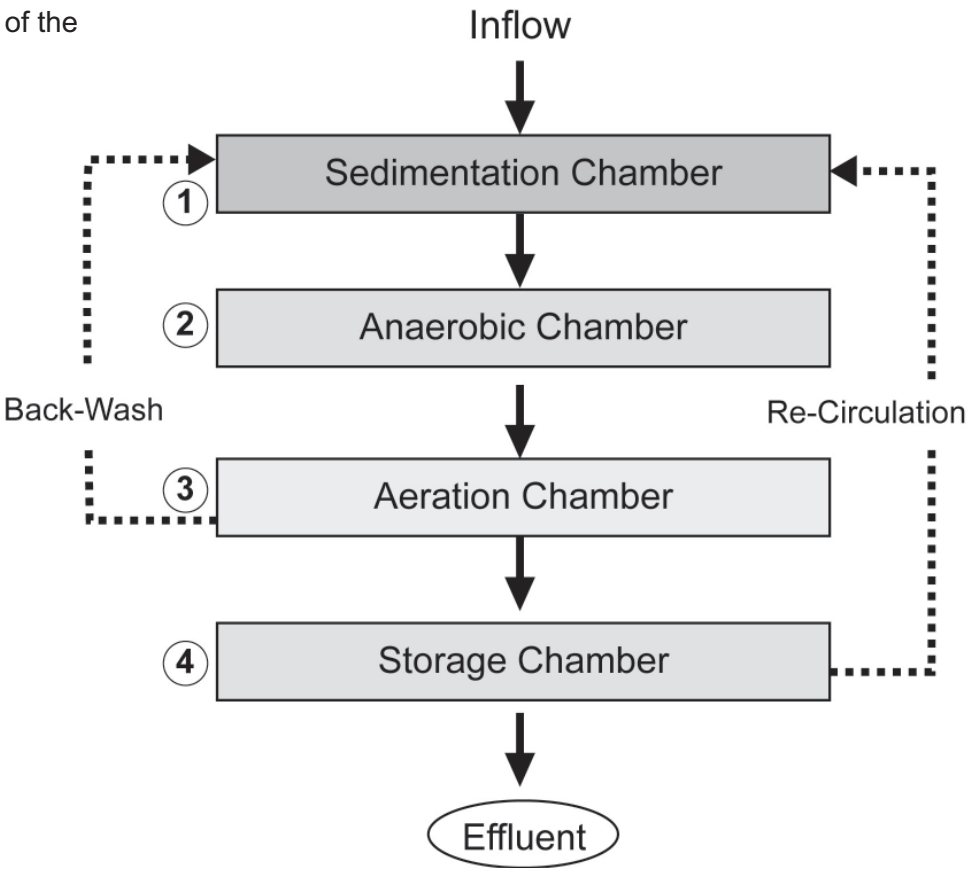


Figure 1. Schematic diagram of the Fusion System.

Figure 2.
Treatment Flow of the
Fusion System.



PROCESS DESCRIPTION

1. **Sedimentation Chamber**
   This chamber is designed to physically separate foreign material and fat/grease (scum) from the incoming water.

2. **Anaerobic Chamber**
   This chamber contains a spherical-skeleton type of filter media (4.3 inch diameter). Through microorganism/bacterial growth processes on the surface of the filter media, biological anaerobic treatment thrives while suspended solids are captured. Furthermore, the microorganisms/bacteria in this chamber convert nitrates in the recirculated water returning from the aerobic chamber to gaseous nitrogen. The nitrogen then escapes to the atmosphere.

3. **Aeration Chamber**
   The aeration chamber consists of an aeration upper section and a filter media lower section. The chamber is filled with hollow, cylindrical filter media (0.6 inch diameter and 0.55 inches long). Biological aeration treatment takes place with the help of the microorganic/bacterial growth on the filter media surface. This aeration is continuous. Residual suspended solids are captured by the filter media circulating in this section. During normal operation, a recirculation line transfers water back into the impurity separation chamber by way of an air lift pump.

   The filter media in this chamber are backwashed regularly (5 or 10 minute cycle, twice a day) by the backwash system located at the bottom of the chamber. The backwashed water is transferred by an air lift pump back into the impurity separation chamber for further digestion.

4. **Storage Chamber**
   This chamber is designed to temporarily store treated water coming out of the aerobic filter media chamber. This treated water is ready for discharge.

INSPECTION AND MAINTENANCE FREQUENCY

Fusion Series systems are inspected and maintained every six months under normal usage. The inspection and maintenance is only performed by personnel trained and authorized by Zoeller Pump Company. A maintenance check sheet is completed for each inspection and maintenance.

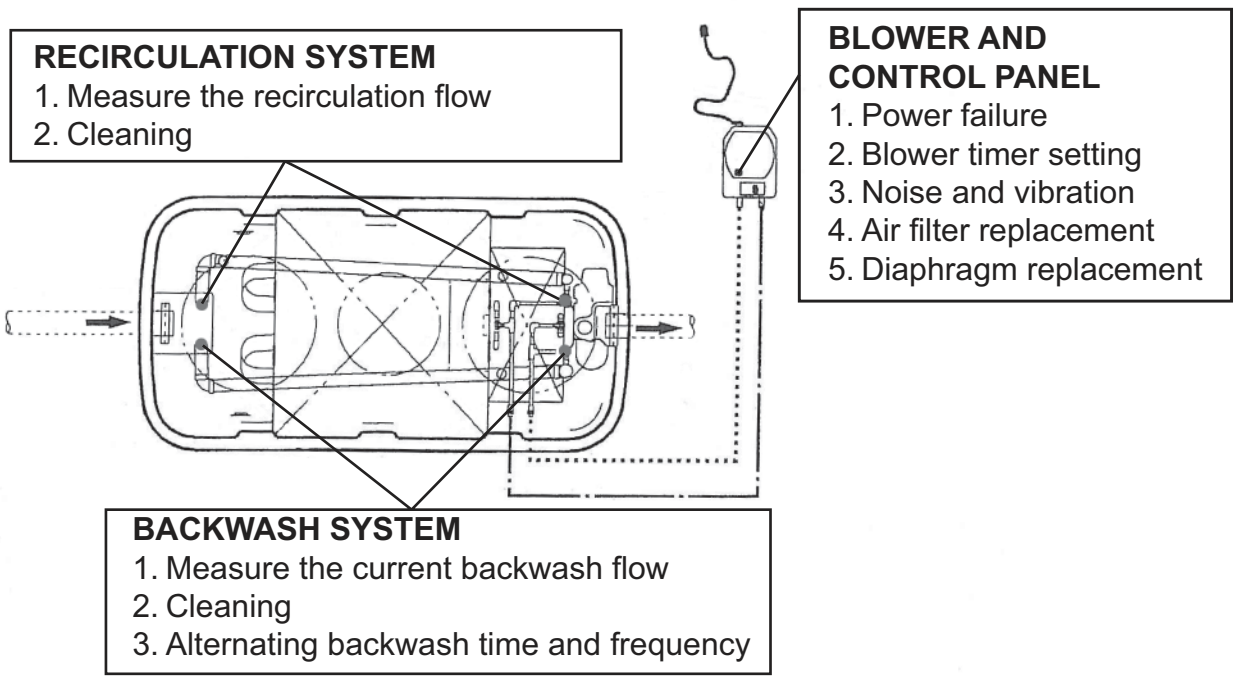
INSPECTION AND MAINTENANCE - 6 MONTH INSPECTION

General Procedure

1. Verify that unit is accessible and nothing inhibits its maintenance.
2. Verify the unit is installed correctly, level and that each component functions properly.
3. Verify the blower is on and operating properly.
4. Verify that there is no damage to tank, piping or other components.
5. Verify that there are no air leaks in air piping and that air piping is connected correctly.
6. Verify that surface water is draining away from unit.
7. Verify that unit is not leaking or liquid surfacing around risers or lids.
8. Verify that operating water levels are correct in each chamber, i.e. between upper and lower level mark indicators and bottom of discharge pipe.
9. Measure the sludge accumulation (inches) of the first and second chamber only. Insert a ½ inch clear pipe or other appropriate device to the bottom of each chamber, then close the top end and remove the pipe slowly. Record the accumulated sludge depth. Typically an accumulation of 30 inches (ZF450 and ZF600), or 40 inches (ZF800) for the first chamber and 15 inches for the second chamber, requires desludging.

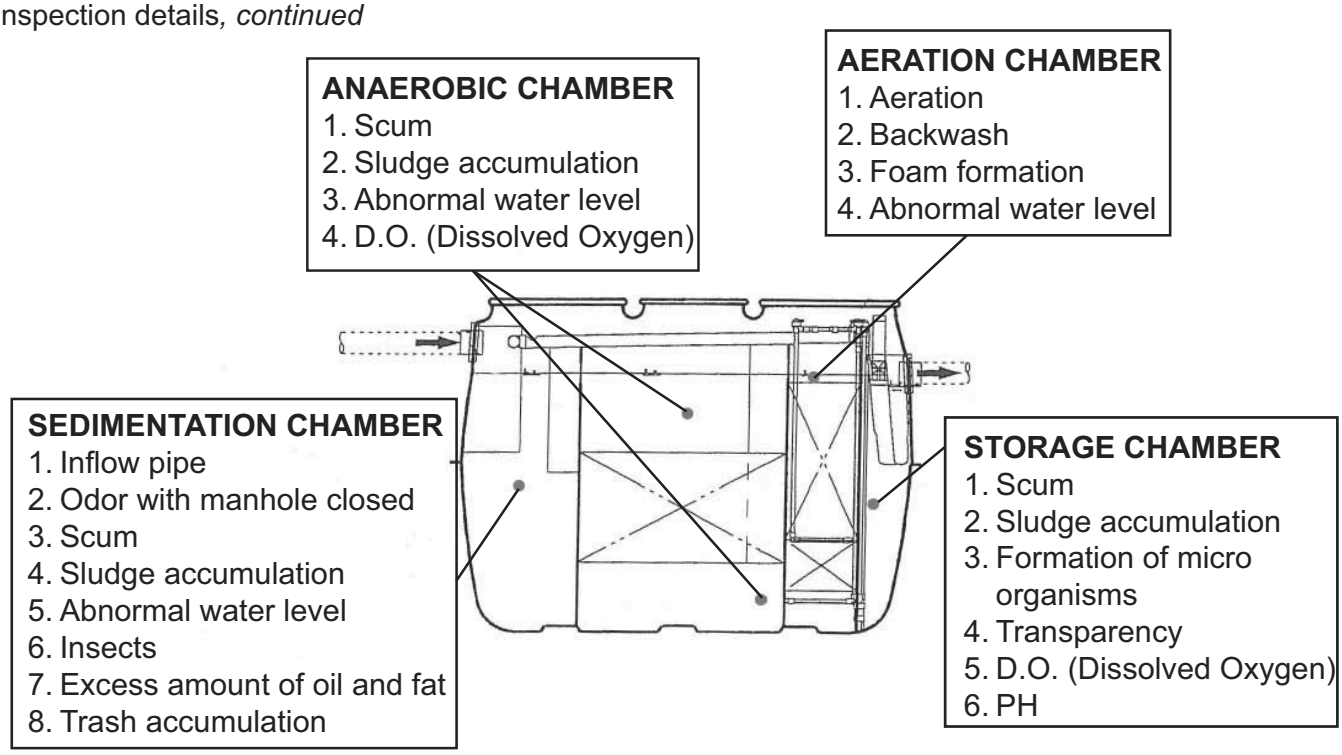
SPECIFIC PROCEDURES

Figure 3.
Inspection details.



SPECIFIC PROCEDURES, *continued*

Figure 3.
Inspection details*, continued*



RECIRCULATION SYSTEM

1. Measure the recirculation flow.

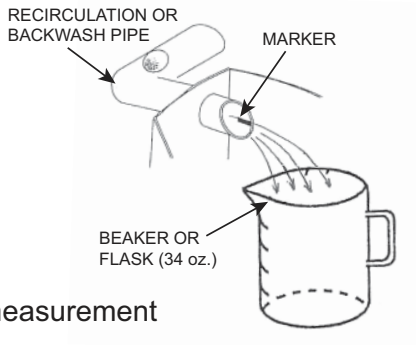


Figure 4. Flow measurement

Measure the current recirculation flow rate. This is very important for evaluating the operational status. Make sure to measure the recirculation flow before adjusting any operational parameters such as valves. Recirculation flow must be measured at the discharge end of pipe in the first chamber (Sedimentation Chamber). Compare the value with Table 1. A lower value may indicate clogging of the recirculation pipe and a higher value may indicate clogging of the filter media. Measure the recirculation flow rate at the end of the maintenance and adjust it to the value shown in Table 1, if necessary.

2. Cleaning.

If the recirculation flow rate is lower than the usual value, clean the airlift pump and recirculation pipe with a brush and hose. To access the airlift pump and pipe, remove the cap (Fig.5) and clean as needed (Fig. 6).

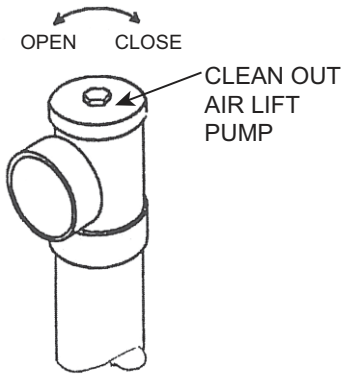


Figure 5. Cleaning airlift pump.

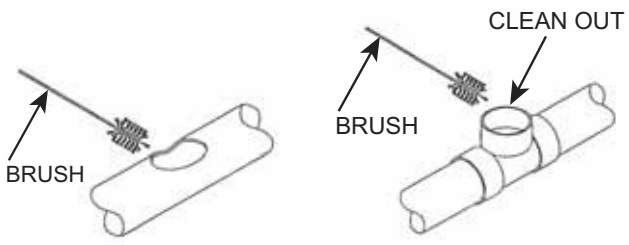


Figure 6. Cleaning recirculation and backwash pipe.

BACKWASH SYSTEM

1. **Measure the backwash flow.**
   Measure the backwash flow rate in a similar fashion as the recirculation flow rate. (See Fig. 3) For piping orientation adjust the backwash flow rate to the values listed in Table 2.

2. **Cleaning.**
   If the backwash flow rate is lower than usual value, clean the airlift pump and sludge return pipe by a brush with water from hose. The airlift pump cap can be unscrewed (Fig.5) and there is a cleanout in the sludge return pipe. (See Fig. 6)

3. **Alternating backwash time and frequency.**
   In some cases, it is better to set the backwash time and frequency to other than the standard value. Consult with manufacturer for details.

SEDIMENTATION CHAMBER

1. **Inflow pipe.**
   Clear foreign objects, if any.

2. **Odor with manhole closed.**
   Make sure there is no undesirable odor with manhole closed. See trouble shooting section if odor is an issue.

3. **Scum.**
   Break scum if scum layer reaches to the top of the baffle.

4. **Sludge accumulation.**
   Measure the sludge accumulation depth, and pump out sludge if accumulation exceeds 30” (ZF450 and ZF600) or 40” (ZF800).

5. **Abnormal water level.**
   If water level exceeds upper line marked on the partition wall, check possible clogging of other Chambers.

6. **Insects.**
   Spray insecticides lightly around lids as needed to control mosquitoes, sewage flies, etc.

7. **Excess amount of Oil and Fat.**
   Confirm and remind homeowner to refrain from disposing too much oil and fat. Additional literature is available from Zoeller for homeowner education. (See FM2382)

8. **Trash accumulation (diapers, paper towels, etc.).**
   Remind homeowner not to dispose indigestible materials.

ANAEROBIC CHAMBER

1. **Scum.**
   Break scum if scum layer reaches to the top of the baffle.

2. **Sludge accumulation.**
   Measure the sludge accumulation depth, and pump out sludge if accumulation exceeds 15” (ZF450, ZF600 and ZF800).

3. **Abnormal water level.**
   If water level exceeds upper line marked on the partition wall, check possible clogging in the filter media part. Clogging may be cleared by the manual backwash pipe (see Fig.8).

4. **Placement of the D.O. measurement.**
   The appropriate location to measure dissolved oxygen in the anaerobic chamber is after the wastewater has been treated in the anaerobic chamber media. This location is in the downstream sludge cleanout baffle.

AERATION CHAMBER

1. Aeration.
Aeration system must be flushed at every maintenance occasion.

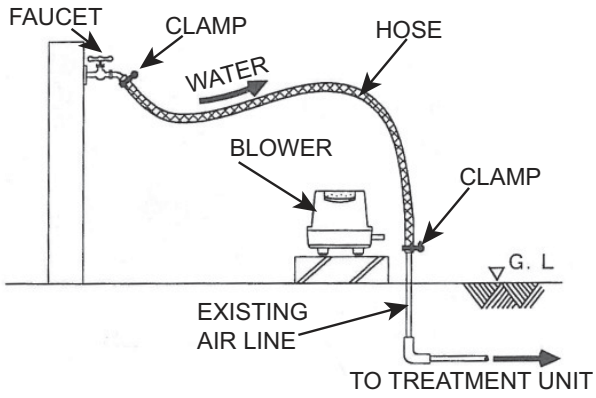
There are two flushing methods; (A) Air flushing and (B) Water flushing. Air flushing has to be done every occasion. Water flushing has to be applied if there is a sign for clogging in the Aeration Chamber (e.g. abnormal increase in recirculation flow).

(A) Air flushing procedure: (See Fig. 10)
- Make sure that blower is in the aeration mode.
- Close the valve (2) all the way.
- Rotate each valve (1) to 0% and 100% position for a few minutes each to flush.
- Set valves (1) and (2) back to the appropriate positions. (See Recirculation System)

(B) Water flushing procedure: (See Fig. 10)
- Make sure that blower is off.
- Close the valve (2) all the way.
- Make the water line as shown in Fig. 7.
- Be sure to use the aeration line.
- Gradually open the water faucet and introduce water into the system.
- Rotate each valve (1) to 0% and 100% position for a few minutes to flush.
- Orient the piping to the original configuration.
- Set valves (1) and (2) back to the appropriate positions. (See Recirculation System)

2. Backwash.
Backwash system must be flushed at every maintenance occasion.
There are two flushing methods; (A) Air flushing and (B) Water flushing. Air flushing has to be done every occasion. Water flushing has to be applied if there is a sign for clogging in the Aeration Chamber (e.g. abnormal increase in recirculation flow).

Figure 7. Image of water flushing procedure.



(A) Air flushing procedure: (See Fig. 10)
- Make sure that blower is in the manual backwash mode.
- Close the valve (4) all the way.
- Rotate each valve (3) to 0% and 100% position for a few minutes each to flush.
- Set valves (3) and (4) back to the appropriate positions. (See Backwash System)

(B) Water flushing procedure: (See Fig. 10)
- Make sure that blower is off.
- Close the valve (4) all the way.
- Make the water line as shown in Fig. 7.
- Be sure to use the backwash line.
- Gradually open the water faucet and introduce water into the system.
- Rotate each valve (3) to 0% and 100% position for a few minutes each to flush.
- Orient the piping to the original configuration.
- Set valves (3) and (4) back to the appropriate positions. (See Backwash System)

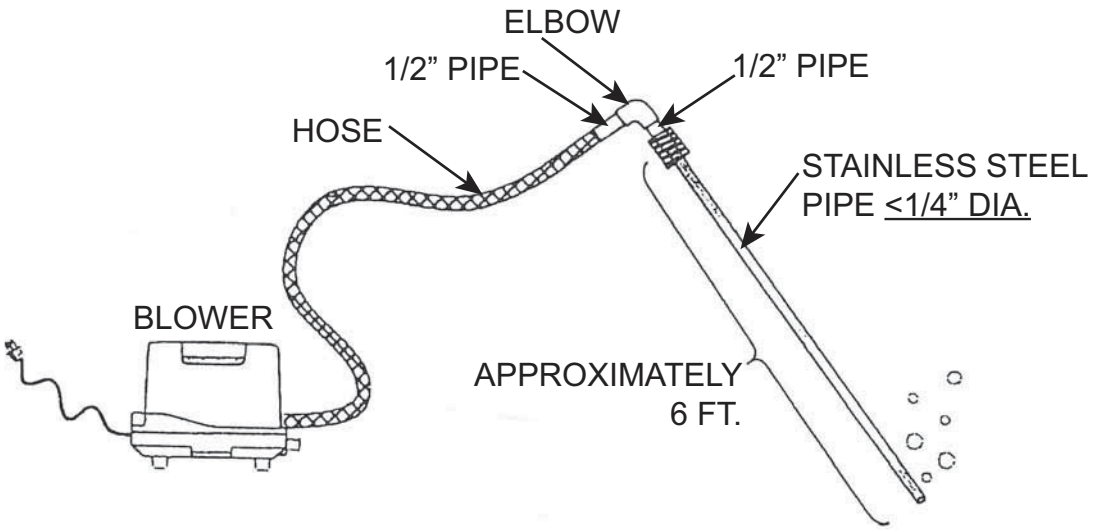
3. Foam formation.
Make sure there is not an excess amount of foam on the surface.

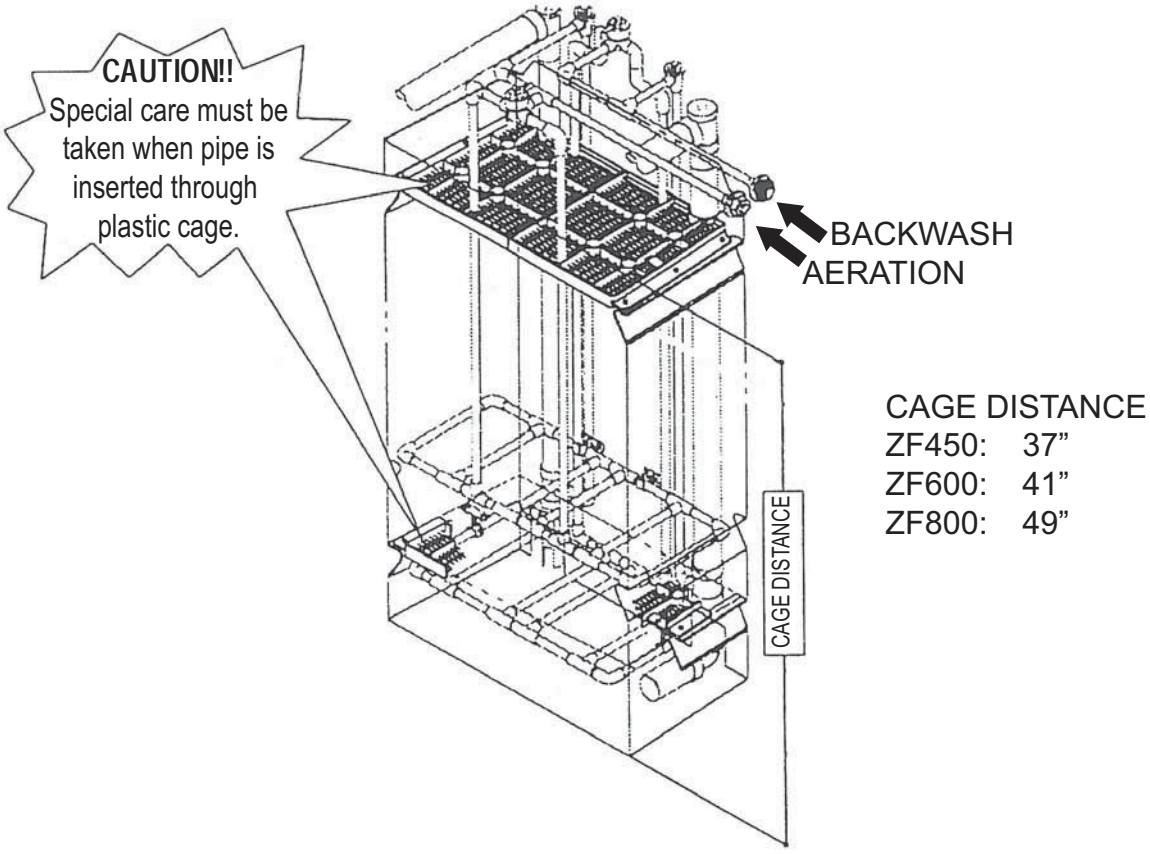
4. Abnormal water level.
If water level exceeds the partition wall, clean the plastic cage first with a brush, then check possible clogging in the filter media section. Clogging may be cleared by the manual backwash pipe (see Fig. 8).

AERATION CHAMBER, *continued*

Backwash, *continued*

Figure 8. Manual backwash pipe for filter media cleaning.





CAGE DISTANCE
ZF450: 37"
ZF600: 41"
ZF800: 49"

STORAGE CHAMBER

1. **Scum.**
   Scoop the scum and discard it into the Sedimentation Tank.

2. **Sludge accumulation.**
   Transfer the sludge to the Sedimentation Tank by the airlift pump.

3. **Formation of microorganism.**
   In case water fleas or other organisms form, remove them with a brush.

4. **Transparency.**
   Clarity of the water should allow visibility to more than 12 inches.

5. **D.O. (Dissolved Oxygen).**
   D.O. should be measured 25 inches below the water level and should be more than 1mg/L.

6. **pH.**
   pH should be in the range of 5.8-8.6. If it exceeds the range, check with the homeowner for excess amount of chemical usage and remind them not to use too much.

BLOWER AND CONTROL PANEL

1. **Power failure.**
   In case of power failure, air blowing stops but all the settings are retained.

2. **Blower timer setting.**
   See attached sheet or Installation Instructions for details.

3. **Noise and vibration.**
   If there is a void between bottom legs and the base, noise or vibration may occur. Make sure the blower legs firmly contact the base.

4. **Air filter.**
   Clean the filter and replace with new one annually.

5. **Diaphragm replacement.**
   It is recommended to replace diaphragm every 2 years. See separate sheet attached for detailed instructions for replacement.

6. **Control panel.**
   Simulate alarm condition with the exterior test/normal/silence switch. Visually inspect interior for wear.

INSPECTION AND MAINTENANCE - 1 YEAR INSPECTION

Perform all inspection procedures listed in 6 month inspection. (See page 1.) Pump out sludge in the first and second chambers.

If the maximum sludge accumulation has been reached, see description in 6 month inspection, item 9.

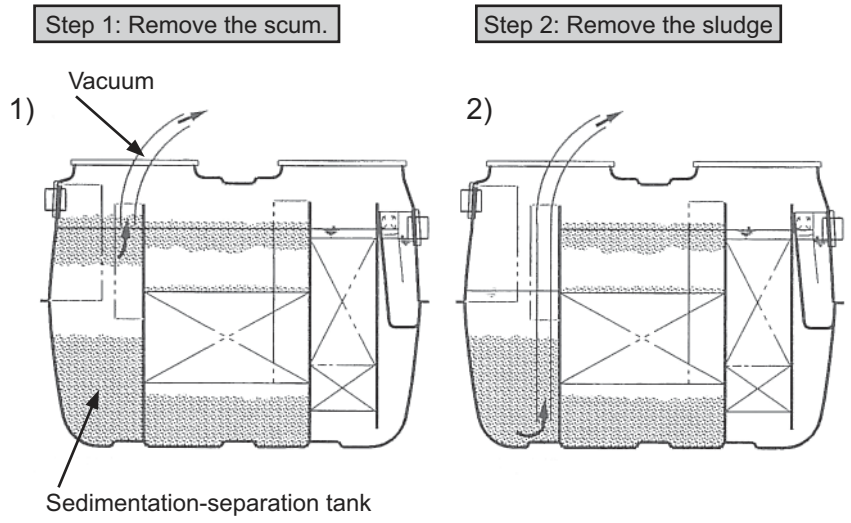
Make sure to remove the scum on top layer first, then pump out the sludge of each chamber (Fig. 9).

See FM2418 for Maintenance Check Sheet.

Figure 9. Pump out procedures.

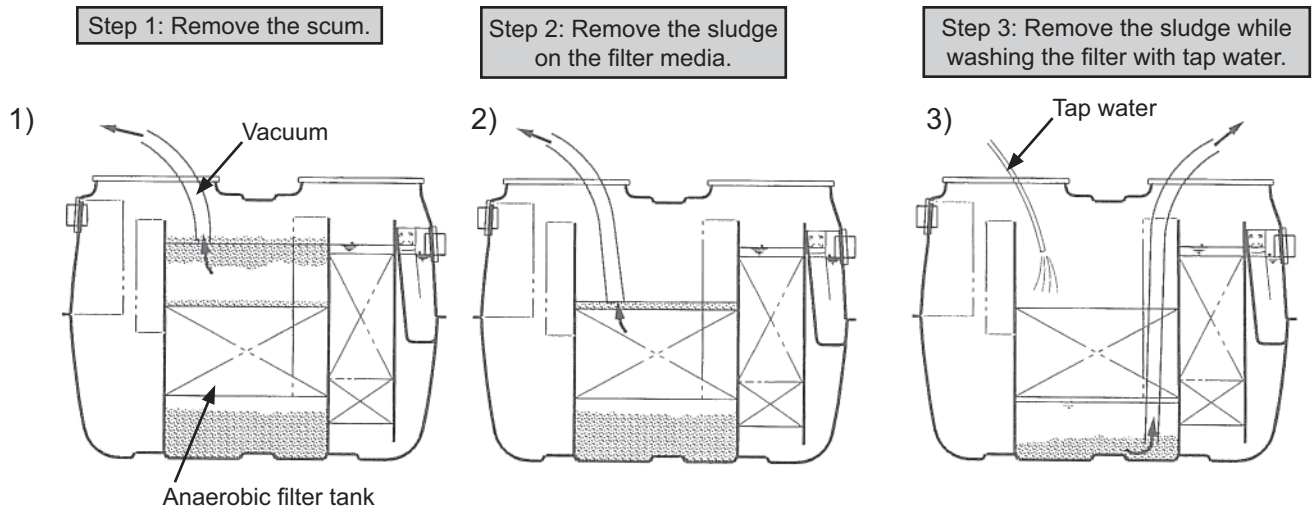
(1) Cleaning of Sedimentation-Separation Tank

Remove all scum and sludge



(2) Cleaning of Anaerobic Filter Tank

Remove all scum and sludge

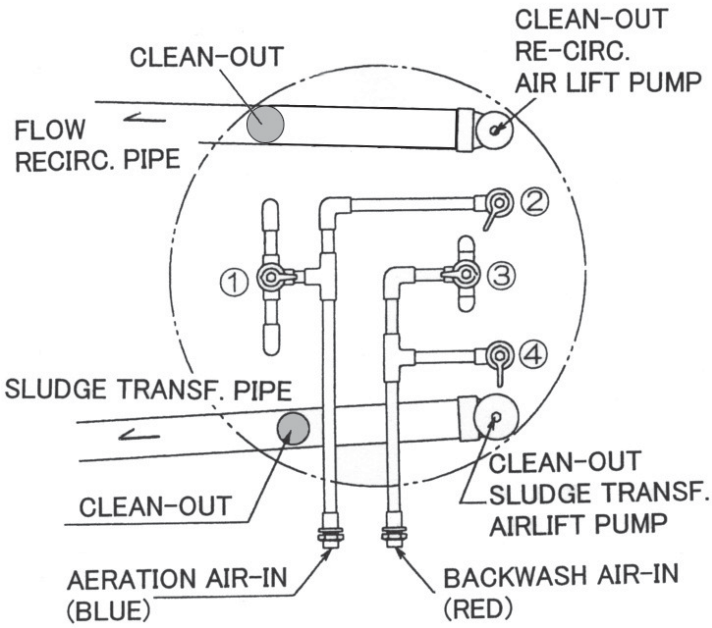


ATTENTION: Remove the scum first. If you remove the sludge first, the water level decreases and the anaerobic filter is blocked by the scum.

AERATION AIRFLOW ADJUSTMENT

There are two aeration systems provided within the aeration chamber. Normally the valve dial is set at 50%. Visually observe the air flow rates on each side of the unit to verify equal flow. If there is an obvious discrepancy in air flow between the two sides, adjust the BLUE color coded air flow valve (1) so that the flow is equal.

Figure 10.
Valve legend.



Valve legend;

①	Aeration	Blue	Balance Aeration
②	Re-circulation	Gray	See Table 1
③	Backwash	Red	Balance Backwash
④	Sludge transfer	Gray	See Table 2

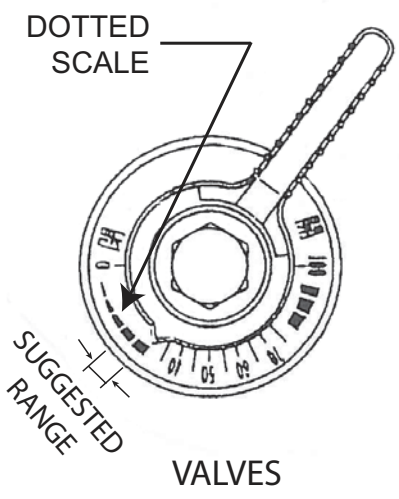
Table 1. Recirculation Flow Rates

Model	ZF450	ZF600	ZF800
Recirculating flow rate (GPM)	0.37-0.55	0.50-0.77	0.74-1.11
Recirculating flow rate (sec/liter)	29-45	21-32	14-22
Suggested Valve Opening	35-40%	30-35%	30-35%

Table 2. Backwash Flow Rate Setting

Model	Frequency	ZF450	ZF600	ZF800
Backwash flow rate (GPM)	Twice/day	1.6-2.4	2.1-2.9	2.6-4.0
Backwash flow rate (sec/liter)	Twice/day	7-10	5-7	4-6
Valve open (%)	Twice/day	50-55	40-45	40-45

Figure 11. Flow controlling valve.



RECIRCULATION FLOW ADJUSTMENT

The recirculation flow is designed to be 1.2-1.8 times that of the inflow. Table 1 indicates approximate flow rates for each unit. However, fine adjustments may be necessary to ensure optimum performance.

Setting the flow rate:

- Adjust the flow using rates in Table 1.
- The flow rate is adjusted by rotating the air flow control valve (2) and observing the flow at the pipe end.
- There is a prescribed line at the outlet of the pipe.
- The lower the return flow, the better the operation.

Measuring the flow rate:

- The actual flow rates must be measured to verify flow after adjustment of the air valve and observation at the pipe end.
- Record the amount of time to fill a one liter (34 oz.) breaker or flask at the recirculation pipe exit. (See Fig. 4)
- Compare the time to values ranges in Table 1.
- If necessary, adjust the air valve again and collect another sample to verify the correct flow rates.

NOTE: It is important not to set the flow rate too high because it can cause excessive agitation within the first chamber (Sedimentation Chamber), which could cause excessive suspended solids to flow into the second compartment (Anaerobic Chamber). This could cause poor performance and odor problems.

BACKWASH FLOW ADJUSTMENT

To prevent the plugging of the filter section of the Aeration Chamber, the backwash operation activates at a preset schedule to optimize the unit's performance. If there is no backwash cycle or too short of a backwash cycle, the unit's performance will be adversely affected. Likewise, if the backwash cycle is excessive, the beneficial bacteria growing on the media will be washed away and performance will be adversely affected.

Typically, the backwash cycle begins at 2:00 AM and lasts for five minutes. One hour later, another five minute backwash cycle occurs. Even if the backwash cycle is set in the automatic mode (as above), the wastewater inflow could be too low or too high to optimize the performance and therefore, must be checked during each inspection.

Calculate backwash ratio using the following guide.

Table 3 lists the appropriate blower timer settings.

a. Ratio of actual number of gallons to the design number of gallons per day.
b. Example:
   Actual number of gallons = 320 GPD
   Design number of gallons = 450 GPD
   Ratio = 320/450 = 0.71
   With a ratio of 0.71, set backwash cycle to two times per day at 5 minutes for each cycle.

Normally, operation of the backwash cycle and sludge transfer takes place at the same time. There are two backwash sides provided within the Aeration Chamber. Verify that the air flow is equal between the two sides during a backwash cycle. If they are not even, adjust the backwash air control valve (3) accordingly.

Table 3. Backwash Ratios

Ratios - calculate actual	Up to 0.4	0.4 to 1.3	1.3 and up
Backwash Frequency	1	2	2
Backwash Time Period	5 min.	5 min.	10 min.

BACKWASH FLOW ADJUSTMENT

Set the backwash flow rate at 20-30% of the Aeration Chamber volume by adjusting the air flow control valve (4). Use Table 2 to determine the typical setting for each Fusion model.

Activate the blower by switching from the auto backwash cycle to the manual backwash cycle position.

Measure the actual backwash flow rate at the outlet of the sludge return pipe in the first chamber in a similar manner as was done in measuring the recirculation flow rates.

Adjust the airflow control valve (4) if necessary to obtain the proper flows.

Return the blower to the standard recirculation position.

There is a clean-out provided at the top of the air lift pump. If the flow rate is suspected of being low because of possible build up of microorganisms, remove the cap and hose the pipe. Use a bottle brush will speed up the process. Replace the cap when finished.

Clean the sludge return air lift pump in the same way.

TROUBLESHOOTING

1. **Odor.**
   Improper operation may cause odor generation. Add seeding material to both Anaerobic and Aeration chambers, also adjust operational conditions such as recirculation and backwash flow rates. Venting the unit with activated carbon filtration may be necessary to eliminate odors completely. Consult factory.

2. **Foam formation.**
   Foam formation is observed in the following situations; in early stage of operation while the amount of aerobic bacteria colony is still limited, excess amount of air is supplied for aeration, the difference between ambient temperature and water temperature is great and an excessive amount of detergent is introduced. Most of the cases, foam will disappear with proper operation. Adding anti-foam agent is a quick option. Seeding is also effective for this. When excessive amount of detergent is introduced to the system, remind the homeowner to use appropriate amount of detergent.

3. **Highly turbid treated water.**
   ✓ Check the amount of scum and sludge:
   If too much scum or sludge is observed, transfer them to the first chamber and adjust recirculation flow rate as well as backwash time, frequency and duration. (See backwash flow adjustment)
   ✓ Check the aeration situation:
   If uneven bubble generation is observed, adjust valve (1). If aeration is weak, flush the aeration pipe by air or water.
   ✓ Check the recirculation flow rate:
   If the recirculation flow rate is abnormally increased after the last inspection, aeration pipe may be clogged. Flush the aeration pipe by air or water. If the recirculation flow rate is abnormally decreased after the last inspection, airlift pump or recirculation pipe may be clogged. Wash them with a brush and running water through hose.
   ✓ Check the color of the returned sludge from the backwash pipe:
   If the color is abnormally dark, decrease the recirculation flow rate accordingly. If the TSS of the water from Anaerobic to Aeration Chamber is high, check the sludge accumulation. If the sludge accumulation reaches the upper limit, pump out the sludge. If not, backwash of the Anaerobic by air using manual backwash pipe prepared for filter media cleaning purpose (Fig.8) may work.

4. **Blower.**
   No Aeration:
   ✓ Check the electric supply.
   ✓ Check the electric current with a voltmeter.
   ✓ Check the auto stopper. If auto stopper is shifted, change diaphragm.

   No Backwash:
   ✓ Check the electric current with a voltmeter.
   ✓ Check the timer. If timer does not go back to normal after depressing the reset switch, replace timer.

   Not enough dispersed air:
   ✓ Check the diaphragm and replace it if necessary.
   ✓ Check for a leak in the air piping.
   ✓ Check the air filter and clean or replace it.
   ✓ Check the air piping for leaks, clogging or dislocation and fix it accordingly.